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The American Biology Teacher

Vol. 12 MARCH, 1950 No. 3

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The American Biology Teacher

Vol. 12 MARCH 1950 No. 3

Report of the New York Meeting

As in previous years *The American Biology Teacher* is devoting most of one issue to a report of the annual meeting. This month we print several of the papers in full or nearly so, together with summaries or abstracts of some of the others. Some of the details of election and other business have already been reported; some other papers or summaries of them are still to be printed.

Teacher-Pupil Planning for Biology*

JESSE V. MILLER
Manhasset High School, Manhasset, New York

The concept of a teacher as an *engineer* of social (and therefore *human*) change has apparently been slow to take hold in science classrooms. It appears that most science teachers do quite well in teaching factual material, fairly well in teaching some of the principles and understandings, less well in bringing about real changes in scientific method and thinking skills, and little of an effective nature in meeting most of the other recognized needs of their students.

Herbert Thelen says in the May, 1949, number of *Progressive Education*, "No amount of effort devoted solely to wiser and shrewder selection of information about our culture will, by itself, result in any very significant improvement in the outcomes of our educational system. It is not what we know, but how we live that matters."[1]

If our teaching is to make any significant changes in the children we teach, our classrooms must become laboratories where real life situations are attacked by methods useful to the child in solving a wide variety of problems. We as teachers must gain perspective and put our *subjects* in their proper places—subservient to the needs of the human beings that make up our classes. If a boy is ill at ease in the presence of girls and worries constantly about his inability to get dates, who would claim to have helped

* Presented at the Annual Convention of The National Association of Biology Teachers, New York City, Dec. 27, 1949.

[1] Thelen, Herbert A., *Resistance To Change Of Teaching Methods*, Progressive Education, Vol. 26, No. 7, May 1949.

him by teaching him the functions of the pseudopodia of ameba?

The short time allowed for this paper is inadequate for a complete discussion of my problem, so I would like to consider only the use of *Teacher-Pupil Planning in meeting the needs of individuals.* Those who would like a more thorough discussion should read the May 1949 issue of *Progressive Education.*

In the Practical Biology classes at Manhasset, teacher-pupil planning is used from the first meeting in September to the last meeting in June. At the outset most students seem to have little or no understanding of what biology has to offer them, or what they can expect to gain from such a course. Each incoming class consists of a mixture of old friends and complete strangers, so only small islands of unity exist.

By conducting discussions in a permissive atmosphere, students get to know each other better, develop an understanding of what biology is all about, and begin to discover and identify the goals they will be working to achieve for the rest of the year and in some instances for the rest of their lives. The teacher plays a much larger role in these initial discussions than will be necessary or desirable when the group becomes more unified and learns to work together.

The *planning* of units for study is the next logical procedure. What problem-area should we study first (or next)? What specific topics should we include? How should we gather materials? How should each topic be presented to the class? What criteria should we consider in evaluating the presentations? What should be the responsibility of the class for the material presented? To what extent should evaluation of a student's total progress be made by the individual, the class, the committee, the teacher?

Obviously in order to use such a method effectively a teacher has to be willing, indeed eager, to develop skill in teaching such goals as improved work habits, the organization and interpretation of data, critical thinking in its broadest sense—including oral presentation, democratic classroom procedures, group-dynamic skills, etc. This kind of teaching requires a considerable amount of record-keeping, planning, and "puzzling" on the part of the teacher. It places a premium on teacher ingenuity and initiative.

The teaching of work-habits involves planning, gathering up-to-date information, organizing the information, and presenting it in an interesting manner. By evaluation of each presentation in a friendly, helpful way by the class, students gain skill, and reduce considerably the boredom which all too frequently accompanies pupil reporting. These reports are valuable also in developing critical thinking. Thinking of any kind requires that the subject have something to think *about.* In answering questions about his report, or entering into a class discussion, a student is frequently challenged to defend his inferences. These are the times when learning of the most effective sort can take place.

Cooperative evaluation is another area where critical thinking can be developed. Occasional class periods spent, at appropriate times, in discussing: "What have we done well so far in this study? What have we done that might be more effective or more interesting if done differently?" will more than repay the time spent in greater efficiency and interest.

Encouraging results may also be expected in the area of self-evaluation of pupil progress. Students and teacher may develop a suitable record sheet early in the year. Students then record each measurable experience and rate themselves on these experiences. Teacher-rated work is also recorded by the student on his record sheet.

As the end of each marking period approaches, students evaluate their progress in each of the areas previously chosen as important, and finally convert the total learning picture into a grade. Thus the student grades himself, in a sense. These student grades are then considered by the teacher, and where a discrepancy appears to exist the student is called in for an individual conference during which differences are adjusted.

Students profit from this experience in a number of ways. Many of them learn, for the first time, the real basis for their grade. Goals are accentuated, and there is less tendency to blame the teacher for a poor grade. Students and teachers avoid friction in cases of doubt, such as the "C+ or B- ?" problem. Students are in a position to identify their weak areas at all times, and can work for improvement if they so choose. Needless to say many headaches are eliminated for the teacher at report card time. Parents find such a report helpful, too, in discussing school progress with their children.

In order to use this method effectively a teacher must be willing to face failure with a determination to try again, and must be willing to take criticism from his students with a smile. For criticise they will if a permissive atmosphere has been established in the classroom. By creating an attitude of "learning together," a "we" feeling toward all activities, both teacher and class will consider criticism as impersonal, and hard feelings will be minimized.

I can assure you this sort of teaching is much more satisfying than traditional lecture-recitation-discussion methods commonly in use. You get to *know* many of your students so much better than you could ever know them through traditional teaching alone. You are in a position to emerge from your experiences as a Social Engineer in its truest sense because you get to know the inner workings of the minds of some of your students—how they think and what they think about, their work habits and attitudes; how they react in a social situation to success and failure, to approbation and criticism from their age-mates. You also learn the extent to which an individual takes responsibility, shows initiative, persistence, ingenuity, and a cooperative attitude. You learn something of their standards of accuracy, and of their dynamic interests and attitudes. Because of these understandings you are in a particularly good position to help students to develop desirable habits, attitudes, and understandings. Your effectiveness will depend on your expertness in the field of planned-development of human beings. Of course, you are faced with a grave responsibility to carry your guidance only as far as your qualifications warrant.

In schools where this type of teaching is not in regular use, teachers should recognize the inherent dangers in initiating such a change. The method may be new to parents, students, administration, and the teacher. The chances for immediate and striking success are unlikely. Most teachers stumble onward toward proficiency. Resistance can be avoided or at least kept in hand by proceeding slowly, by succeeding with each small change before another is introduced. Often if the students can be convinced through actual classroom experience, the other groups will go along. At least, this has been my experience. One should expect opposition; it is the unexpected that often catches us napping. By watching the pulse of the opposition one can gauge better the pace with which to proceed.

Much more clasroom experimentation with teaching methods is needed. Biology teachers can perform a valuable service by writing up their experiences, emphasizing *how they did it*, and *in*

what respects it seems more effective. The editor tells you how to write up your studies in the November, 1949 *American Biology Teacher.* Let's share our experiences!

A High School Science Service*

JAMES G. HARLOW
University of Oklahoma, Norman, Oklahoma

When Dr. Lockwood invited me to this symposium to present a paper describing the High School Science Service of the University of Oklahoma, she asked that I tell how and why the service was begun, what the range of the present service is, how other groups could get similar services started, and so on. Taking her suggestion as the basis of the content of my paper, I have set up three topics for presentation: first, what the present University of Oklahoma School Science Service is, what it does, and whom it serves; second, how this activity came into existence, and how it now is supported, and third, the suggestions which our experience has for those who would like to undertake similar things in their own areas.

I

The High School Science Service has a formally stated aim, which, briefly, is to promote in Oklahoma general education in science, to help in the location of talented young people in the fields of science in Oklahoma secondary schools, and to improve teacher training programs in science at our own institution. This is admittedly an omnibus kind of objective; it includes practically everything done in schools in the science area below the second year in college; theoretically it includes all of adult education in science in general education fields; and it is concerned with all the state secondary school population in its search for scientifically promising young people. It is a service seeking to reach all science areas, including that of biology.

* Presented at the Annual Convention of the National Association of Biology Teachers, New York City, Dec. 27, 1949.

In attacking this broad aim, two divisions of the work appeared immediately. The first was the planning and teacher education branch, whose activities are limited to our campus, and the second was the field branch which deals with all of the off campus activities we maintain.

In evaluating our on-campus activities, it is important to remember that the University of Oklahoma is a relatively large institution. Its enrollment is approximately eleven and one-half thousand students, and it has eight divisions which are concerned with science education in some way. These divisions are our six science departments, physics, chemistry, plant sciences, astronomy and mathematics, zoological sciences, and geology; our college of education, and our extension division. Since all of these divisions are interested in the development of science programs anywhere in our state, we do all our planning and program development in a twelve-man advisory committee, which represents all our science departments, the college of education, the extension division, and includes one or two other individuals on the basis of their strong interests in this field of work. The membership of this committee has been carefully selected, and in all cases represents a strong interest in general education and in public education in science. Eight of the twelve members are Ph.D. people; nine are directing research in science, science education, or education. All except one are active college teachers at the present time; five have had substantial secondary school teaching experience, and another two have had extended college

training in education in addition to their science Ph.D.'s.

This presentation of the committee characteristics stresses the homogeneity of the backgrounds of its members; you may rest assured, however, that committee meetings are not quite lavender and old lace functions! However, in spite of the diversity of professional interests, the special departmental interests and the inescapable minor personal frictions which characterize any group of this size in academic circles, we manage to agree to a rather large set of operating plans and projects, which it is my function to implement as director of the service.

Our current project is the development of science teacher curricula, on a university-wide basis, to meet recently altered state certification requirements. This project will require most of our available committee time for the remainder of this school year, I imagine. Last year, the committee's main project was the establishment of a general science course especially for teachers, taught and financed interdepartmentally by the science departments. You may have seen a report of this course a few weeks ago in the AMERICAN BIOLOGY TEACHER. The year before that, we were occupied with the establishment of our field program which for the present, due to financial limitations, is directed particularly toward secondary science teachers and students.

Administratively, the off-campus section of the High School Science Service is a department in the university Extension Division. All its field activities are directed in integration with the remainder of the university extension program, itself a large and varied program. The articulation with this program is carried out through the participation of our extension director in the activities of our advisory committee. At this time, the field activities of our service include loan collections, consultant services in science and science education, a series of science leaflets devoted to topics of interest and use to science teachers, a weekly radio program on the university radio station, science club services, speaker services in science and science education fields, an anuual science fair conducted on a state-wide basis, a curriculum library, and a bimonthly science education bulletin distributed free to every secondary science teacher in our state.

Our loan collections are being built to meet two aims: (1) to provide relatively unavailable information concerning local items of scientific interest or teaching usefulness, and (2) to bring to the attention of teachers new materials, and enrichment materials which they are unlikely to provide for themselves. In the first category are the items of greatest interest to biology teachers; at present we are lending sets of Oklahoma trees and other flowering plants, arranged as plastic-covered display herbaria, groups of twenty-five plastic-embedded Oklahoma insects, and the records of frog and bird calls of the Comstock Publishing Company. The preserved materials are properly classified, and are accompanied by manuals which describe the life habits of the organisms in the collections. These collections are being expanded as rapidly as conditions permit; we hope eventually to be providing study collections of all the conspicuous life forms of our area.

In the second category of our loan collections we are currently providing three kinds of materials in the field of atomic energy education. We have the Life Atomic Energy display, mounted sets of the Westinghouse Nuclear Energy Charts, and a demonstration Geiger Counter now available on loan. These materials too are being expanded as our financial conditions permit. All loan dis-

plays are free to Oklahoma residents, and users pay only transportation costs.

Our consultant services are the technical services of our instructional staff in science and science education, and are made available on an actual expense basis to schools and other organizations which request them. We have provided assistance in the redesign of school laboratories, curriculum revision, identification of difficult life forms, repair and overhaul of apparatus, and so on. We send specialists to schools whenever necessary under this part of our program.

Our weekly radio program is a fifteen minute popular science program on the University-owned station, which covers effectively a 125 mile circle around our institution. The program reports scientific developments from a wide range of basic science journals, and seeks to be popularly intelligible, as well as reasonably accurate.

At present our science club services are limited; we have some materials available for free distribution which provide help in program planning and contacts with other science clubs. This work is being so well done by the publications of Science Service that we have found little effective material to add to their Sponsor's Handbook other than local information and news.

Any school or other group can schedule speakers from our science faculty through our High School Science Service. The demand in this area is light; we provide ten or so such speakers per school year, mostly to science clubs, assembly programs and adult study clubs.

Our first science fair, held last year, attracted 125 exhibits, of course distributed through all science fields. This year we are expecting nearly 100 per cent increase in that number; the fair idea was new in our state last year, and our teachers had to become used to it. In addition, we are hampered by the large distances between places in the Southwest; exhibitors at our science fair have to make arrangements to be away from home overnight, a condition not always easily met by secondary school youngsters.

In our curriculum library, there are several hundred books, workbooks, laboratory manuals, and curriculum bulletins in science and science education all of which are available on free loan to any teacher requesting them. We actively collect these items, and are hoping to make this section of the service a basic research aid in science education for our state.

We now are distributing thirty-two science leaflets free of charge to Oklahoma residents. These leaflets are mimeographed, and include everything from directions for raising earthworms to apparatus lists for elementary science programs. There are directions for making school darkrooms, and for making small aquaria; there are bibliographies for atomic energy education, for readings in geology and paleontology, and reports of local interest, such as descriptions of our glass industry, our state mineral resources, the production and distribution of natural gas, and so on.

The bimonthly bulletin of the High School Science Service is a four-page printed leaflet distributed free of charge to all secondary school science teachers in Oklahoma. It serves as a reminder of the various services available to teachers through the service; it provides teaching ideas, science club news, news of our state Academy of Sciences and the Junior Academy, and also any other items of interest to Oklahoma science teachers. We would like to distribute this leaflet more broadly, but its cost prohibits distribution, for example, to superintendents and to elementary teachers. This bulletin provides the continuing contact of the Service with the in-

dividuals which it seeks to serve. It is distributed in September, November, January, March, and May.

Last school year, approximately one hundred fifty of Oklahoma's nine hundred secondary schools made some use of one or more of the High School Science Service facilities, other than the bulletin. Probably the most active items last year were the leaflets; this year the most active items seem to be the loan collections. Some of them have been out of the office since the start of school; this fall they have been viewed by more than five thousand school youngsters in science classes.

As extension programs go in our institution and in other large universities, the High School Science Service is not considered a large program, in terms of the number of people who participate in it. This fact we believe to be a reflection of the rather inadequate science education program in our area, the educational situation which the service itself was established to remedy. We are confidently expecting a noticeable annual growth in the number of participating schools in the field aspects of our program.

II

Now for the second of the major topics, how the High School Science Service was developed and how it is supported.

The movement which culminated in the establishment of the High School Science Service is a little more than ten years old in Oklahoma. It began in our state Academy of Science, which for many years has maintained a special committee devoted to the development of high school relations for the Academy. During 1937 and 1938, this committee began the development of a consultant service for secondary schools in science and science education, based on voluntary time contributions from members of the Oklahoma Academy of Science. It also attempted the development of loan collections, and used the then available WPA museum projects to help in their establishment. This whole project was stopped by the war, and lay unused for more than four years. A new line of development, the Science Clubs of America movement, then made itself felt on the O. U. campus, again through a president of the Oklahoma Academy of Science who happened to be the chairman of Zoology. This man took his idea to the director of the University Museum, who had for many years been interested in science club work and public school science. Together, they began the discussions with the University administration which eventuated in the establishment of the High School Science Service. These discussions, it must be admitted, were greatly facilitated by the fact that Dr. George L. Cross, the president of the University, a former president of the Oklahoma Academy of Science, is himself a professional botanist, and was familiar with the earlier ideas developed in the high school group in the Oklahoma Academy of Science.

At the present time, the actual work of the field parts of the Service are carried on by a half-time stenographer, a half-time director, and paid student help as needed. The service has its own office in the new Research Institute building, and has a work room assigned as well. Its operating money, including travel expenses for school visits inside Oklahoma, is borne by a regular University appropriation. The director's salary is paid from the instructional budget; the remaining half-time is assigned to physics teaching.

III

The third division of this paper is a group of suggestions for the establishment of similar services in other areas.

Probably the most significant inference from our experience in Oklahoma is that the sine qua non of this kind of enterprise is the location of interested people. After two years of work with it, my own conviction is that it probably would be impossible to establish such a program as this without accurate, personal knowledge of the individuals who are to provide its guidance and support. This problem might be less critical on a small college campus in which there is a single science department instead of six different departments, and more interest in teaching than in research. However, smaller institutions may not command the prestige over large areas which is enjoyed by the larger colleges, so that while the planning and campus activity might be easier in a small school, the actual establishment of the effective field contacts for the service might be more difficult.

The financial requirements of our service are not especially heavy. We now are mailing our bimonthly bulletin to about twelve hundred persons in Oklahoma, and are carrying all additional expense on a total annual budget of slightly less than two thousand dollars, exclusive of salaries for the stenographer and the director. This load is large enough, however, that it practically precludes the establishment of a permanent service by any ordinary voluntary organization of scientists or science teachers.

For a packaged set of recommendations for procedures in the establishment of other services similar to the one at the University of Oklahoma, I would present these:

First, locate a group of individuals in your state teachers' organization or in your state academy of science, or both, and get them to consider, plan and agree to support the building of such a service.

Second, locate established faculty members of some local institution of higher learning who are interested in public school science, preferably involving as many as possible of the science departments of that institution in your discussions.

Third, provide the support of your own group for those faculty members in an attempt by them to interest their extension director, other field contact agency or administrative officer in science service work. Extension and field service directors are congenitally sensitive to opportunities to extend the contacts of their agencies, and it is from this source in most cases that institutional funds will have to come to support the actual operation of the service.

It has long since been trite to observe that science has become the basic activity of the United States, and in the same breath to note that the general population is poorly informed in science fields. With the report of the President's Commission on Higher Education and the Report of the President's Scientific Research Board, there is immensely authoritative support for the view that better education in science is one of the crucial needs of our time. The University of Oklahoma Science Service is one attempt to meet this need on a broad public institutional basis, through enrichment programs for existing science education activities, through better preparation of science teachers and through the location of the talented young people who are our primary reliance for the healthy economic order of the future.

The Use of 2″ x 2″ Photomicrographs in the Teaching of Biology*

ABRAHAM MARSHALL WECKSTEIN
Barringer High School, Newark, New Jersey

During the past 20 years, we have witnessed tremendous strides in our efforts to make the study of microscopic materials more readily and completely understood by our students. The use of charts and models has helped to enrich our biology program. With the development of micro-projection apparatus, it becomes possible for the biology teacher to show a microscopic object to the whole class at the same time and to be sure that the students have their attention focused on the really important things.

In 1930, Black (1) had reported his experiences with the use of micro-projection apparatus in several German public secondary schools. He concluded as follows: "After all, if a student studies biology for only one year, it seems a needless expenditure of time to teach the technique of using the compound microscope. If he is going on in biology, this is absolutely necessary, and therefore, is commendable; but in our general course it would seem that we might better show the results of using the microscope."

In 1933, Stathers (2) conducted an investigation to compare the relative effectiveness of instruction in biology by use of the individual microscope method and the micro-projection method. Stathers found that the micro-projection method was 19% superior to the individual microscope method in terms of learning factual material and that its use resulted in a saving of time of 50 to 75%. He concludes that "instead of only one individual viewing the specimen, a class views it as it really is; not haphazardly, but directly."

In 1934, Fitzpatrick (3) in his *Biology for Public School Administrators* concluded: "It is far cheaper to supply a class with a micro-projector than to furnish each student with a microscope."

In 1939, the author (4) of this article reported that 44% of the schools located in cities of 100,000 or more population were equipped with micro-projection apparatus. However, it was found that slightly over 25% of these schools reported that their micro-projectors did not function very well. When this was the case, the teachers were inclined to stop using the micro-projector and returned to the use of the individual microscope method. In the author's own school, for example, with four teachers of biology, the micro-projector is only occasionally used for the demonstration of living specimens. You may rightly ask: "Well, why don't you use this excellent piece of equipment more than you do," The answer to this question is as follows:

1. With three rooms equipped for the teaching of biology, it becomes most difficult to move the micro-projector from room to room. It is too expensive a piece of equipment so that one can be provided for each room for permanent installation.
2. Teachers want demonstration materials available for immediate use and not after they have finished their observations and discussions.
3. The micro-projector can only be used in a completely darkened room. Such

* Presented at the Annual Convention of the National Association of Biology Teachers, New York City, Dec. 27, 1949.

rooms are not always available. Besides, it is undesirable to subject students to complete darkness day after day.

As a result of these inadequacies of the micro-projector, 2″ × 2″ Kodachrome photomicrographs were used to replace and supplement the individual microscope in the examination of microscopic materials. Many of these slides were prepared by the writer; others were purchased from such supply houses as Clay-Adams Co., Inc., the Carolina Biological Supply House, the General Biological Supply House, and the Society for Visual Education. It is possible to use these slides in a semi-darkened room, and by the use of a shadowbox, in a completely lighted room. The preciseness and superior value of these slides as compared with the micro-projection method has become readily apparent.

Each of the three biology rooms at Barringer High School is equipped with a lantern slide projector, a strip-film projector, and a 2″ × 2″ slide projector. This equipment is permanently installed, and has required little or no mechanical attention. The three 2″ × 2″ projectors were purchased for less than one-half the cost of one micro-projector. Besides, they are available just when the teacher wishes to use them. Shadowboxes, built by the students, are also available. A complete set of slides has been assembled for use by our teachers. These slides can be purchaed for approximately $1.00 each, permanently mounted, and should last for many years. Thus, the cost of one slide obviates the cost of twenty or more microscopic slides. The saving in money is tremendous. Even if one set of 2″ × 2″ slides were provided for each room, the cost of such material is negligible as compared with the continuous replacement of microscopic slides.

For the examination of living microscopic forms, the micro-projector is still being used. Each time this apparatus is used, however, the writer keeps wishing for a more reliable and inexpensive piece of equipment to do the same job. Surely, in this atomic age, such a piece of equipment will soon be available.

With academic classes in biology, several students have been permitted to record their observations by photomicrography rather than by the drawing of specimens or through the completion of prepared drawings. Is this not the method for accurate observation and research? The potentialities for the use of such equipment are tremendous.

When students do individual microscope work, 2″ × 2″ photomicrographs of the same slides used by the students are employed by focusing the slide on the shadowbox in the completely lighted room. This obviates the use of companion eyepieces. The teacher can then be sure that the student sees what he is supposed to see.

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Make Your Own Color Slides*

BROTHER H. CHARLES, F.S.C.
St. Mary's College, Winona, Minnesota

The development of a real love for the out-of-doors should be one of the primary aims of any biology course. Consequently, our biology courses must give inspiration as well as information. The joy of living is much fuller for those of us who have a friendly acquaintance with the things God put in the fields for our enjoyment. Our biology courses should be geared to promote an intelligent enjoyment of the various plants and animals. And we should be so filled with enthusiasm for the biological information we have that we are more than eager to show our students the wonders we see in Nature. Are our biology courses well-knit series of units which introduce the students to the great principles and wonders of Nature in an interesting manner? Or, are they a study of isolated specimens which are dead, evil smelling and only remotely related to making living both effective and enjoyable?

We answer these questions in the job analyses which we make from time to time in order that our technique of instruction as well as our fund of information will not become static. It is beyond the scope of this paper to analyze the entire job of instruction. But, I would like to consider with you the production and use of the 2×2 inch slide as a means of making certain biological ideas effective and real to our students.

To develop an understanding of and an appreciation for things biological students should have contact with living things. We realize that, and provide laboratories in which we establish aquaria, vivaria, terraria, and even small greenhouses. But, we realize these are inadequate. Students should go into the fields and study living things in their natural surroundings. However, the tendency to concentrate our students in large schools which are far removed from the wide open spaces, and the large number of students which each of us is expected to teach, make the occasional field trip difficult and frequent field trips for all of our students quite impossible.

Effective general education demands a knowledge of biological facts and principles which are far beyond the scope of experimentation of our laboratories. How climate, soil, and other factors of the environment affect life; how plants and animals are interrelated and interdependent; and how our natural resources should be used for man's continued well-being must be taught. But how are these essential ideas to be presented to the students in an effective manner? Words alone are woefully inadequate. Since few of us live in regions readily accessible for field work we must resort to pictures which stimulate interest and which step beyond the limitations of our vocabulary and that of our students in helping them grasp the ideas we strive to present.

Movies, film strips and slides are available in a multiplicity of subjects. Many of them, however, are not exactly suitable for the subject matter, the particular community in which we teach, or our methods of presentation. Consequently, we either adapt our presentation to the available visual materials, or we build our own. Regardless of whether we take the pictures or inspire and direct our

* Presented at the Annual Convention of the National Association of Biology Teachers, New York City, Dec. 27, 1949.

students to take them, I believe we can and should build our own. Such visual aids are tailored to our methods of instruction; are more easily and completely interpreted since we have first-hand knowledge of the details included; and are most effective in inducing students to go out and get acquainted with the living things in their area.

Effective movies are difficult to produce. The technique of the camera is not complicated, but cutting and editing require consummate skill. Few home-made movies on biology are coherent, complete and satisfactory.

Film strips contain sequences of pictures most of which have been taken under many different conditions. Unless we limit ourselves to black and white film there is little chance of our making uniformly adequate strips for projection. And, once the strip is made the sequence of presentation is fixed.

The 2×2 inch slide made with color film is easily produced and offers the greatest opportunity for use. The production, projection and storage of such slides are reasonable in cost. The projectors are easily handled and the slides can be used in any sequence desired.

The equipment necessary for the production of the 2×2 inch slides should include a 35 mm. camera, supplementary lenses for closeups and for distance shots, a lens hood, a haze filter, a tripod and a light meter. Pamphlets and articles in current magazines give detailed instructions for the mastery of these tools. Once you know the characteristics of your camera and meter and the allowances you must make for the type of color film used 90% of your results should be technically satisfactory.

Before discussing the production of slides may I stress the fact that while technical perfection is desirable it is less important than knowing WHAT you want and WHY. Knowing WHY you want the picture is probably the greatest factor in getting satisfactory results. This presupposes a careful appraisal of what you need in order to present each lesson effectively. After you have decided exactly what each picture should show you are better able to select suitable localities for your pictures or to make use of those exceptional opportunities which occasionally present themselves to those of us who walk the fields. Also, you know how the pictures should be composed to bring out your ideas.

For nature photography, 35 mm. cameras are most convenient. They are easily carried in the field, can be brought into action quickly, and the images on the film are sharp enough for great enlargement. They are equipped with lenses which are corrected for color and an f/3.5 lens is fast enough to stop the action of most animals when the shutter speed is set at a hundredth of a second. Such cameras are equipped with a range finder which is very convenient for sharp focusing. Supplementary lenses are frequently used for closeups and then the focus is determined by measuring the distance from the lens to the subject. A lens hood should be used at all times to prevent haze resulting from stray beams of light.

A telescoping tripod is stable enough for small camers and should be used whenever possible. The composition of the picture is more easily controlled, fuzzy images resulting from movements of the camera are avoided, and those long waits which often occur before the subject is in the desired position are not so tiring.

Correct exposure is very essential for accurate, brilliant color pictures. Sheets issued with color film give exposure data for certain typical situations but the conditions under which a nature photographer must work are so diverse that a meter of the photoelectric type is a nec-

essary part of the equipment. An exposure record should be kept until you are thoroughly familiar with the performance of both your camera and the meter in the various situations under which you take pictures. I find that the lens opening and exposure time indicated by my meter when held in the camera position give fine results for pictures taken at distances from 16 inches to 8 feet. For scenes at greater distances meter readings are taken in the various parts of the field of the camera and the exposure established midway between the greatest and least light intensity. As long as the difference in light intensity in one part of the field does not exceed that in other parts by more than eight times I usually get a satisfactory overall record. However, extremes in light intensity should be avoided. Pictures of subjects only partly in bright sunlight will vary from faded, thin records in the well lighted areas to dark reds and blues in the shaded areas. Sharp shadows may be reduced by shading the subjects with a single thickness of white cheese cloth. Many of my best pictures were taken when a tiny white cloud shielded the sun. On cloudy days and whenever I take pictures of objects more than a thousand feet distant I use a haze filter in the lens hood to prevent excessive blueness.

Naturalness is a prime requisite of effective pictures. The more nearly our illustrative materials approximate the actual conditions of the biological phenomena being presented the better they serve in conveying our ideas to our students. Consequently, the plants and animals should be photographed where they grow. Pictures taken in the field are more natural to the eye and are more suitable for teaching purposes since they include enough of the natural surroundings to show the typical habitat of the particular organisms.

Most color films are processed by the manufacturer and are returned mounted in cardboards called Ready Mounts, which are suitable for immediate projection. Ready Mounts are light, durable, allow for contraction and expansion of the film and are easily handled in modern projectors. The principal objection to them is that the film is exposed to dust and finger prints. Films are better cared for if they are mounted between glass plates. The glass plates are either two inches square and bound together by adhesive tape, or smaller and held together in a narrow cardboard rim by means of aluminum coated paper which also serves as the mask. I prefer the second type since less breakage results from the rough handling often given classroom materials.

An efficient system of slide storage is necessary if the slide is to be readily available at the time we wish to use it. The fact that each biologist seems to have his own way of caring for his slides may indicate that no "best way" has been developed. Regardless of what system you use the slides should be labeled, numbered, indexed at least according to subject and filed in light-tight drawers or boxes. Finally, each lesson plan should be accompanied by a list of the sequence of slides which are most suitable for that particular lesson.

The Place of Anthropology in the Biology Course*

HAROLD NAGLER

James Madison High School, Brooklyn, New York

A recent questionnaire to the academic high schools of this city revealed that fewer than ten percent include a unit on anthropology in their biology course of study. Of those reported the average time given to this subject is only four days. It is probable that less than half of this time is devoted to the study of race and racism.

Many teachers of biology regret this negligence of a very serious social problem. Yet they find that the pressure of other demands impedes the realization of their annual September resolve to do a good job on the biology of race differences.

A suggestion that may be helpful to them is not to consider the addition of another unit to an already crowded course of study. We urge that they include in some of the topics a brief discussion of those points where the facts and principles of the topic impinge on those of the biology of race. The most important of these is Genetics. When the pupils understand what is inherited and what is not (insofar as such distinction is possible) he is on the road to understanding what a race is. The distinction between the germinal and the somatic is also the distinction between the racial and the cultural.

Racist doctrines are based on the assumption that such distinctions do not exist. When the young student learns something of the nature of the gene and its interrelation with the body he will begin to appreciate the basic fallacies of the racist doctrines.

* Presented at the Annual Convention of the National Association of Biology Teachers, New York City, Dec. 27, 1949.

The studies of Franz Boas on European immigrants to America and of H. L. Shapiro on Japanese immigrants to Hawaii show the great sensitivity of many physical characteristics to the environment. These data indicate that even without racial mixture the bodily form of the immigrant group tends, in successive generations, to resemble more and more the physical traits of the native population.

In studying hybrid vigor in plants and animals it is well to point out that current racist doctrines concerning so-called "mongrelization" and the evils of race mixing contradict the evidence. While there is little evidence of hybrid vigor in man there is none that intermarriage is biologically harmful. Studies of mixed groups have been made in Hawaii, Brazil, South Africa and Pitcairn Island. Some of these data are not too difficult for high school students to understand.

When we study the topic of public health sooner or later someone brings up the question of racial differences in immunity to infectious disease. Interesting data on this are to be found in *Immunity* by Zinsser, Baynes and Jones. As you peruse the sections devoted to the many diseases you will notice near the ends some of the sections a paragraph or two on the matter of racial differences. In each case the experimental data are referred to and evaluated. And in each case the verdict is: "Not Proved." For instance, it was reported that in an epidemic of yellow fever in Charleston, the Negroes had a lower mortality than the white population. It was believed by

some that this was a case of a true racial difference in immunity. The authors of the text, however, show how the reports failed to consider the possibility of previous exposure with the elimination of the more susceptible Negroes. The latter live in an exposed neighborhood where there may be some endemic yellow fever unrecognized by the health authorities. When material such as this is discussed in class one has an excellent opportunity to demonstrate scientific thinking.

When it comes to general physiology it is well known that some groups of people appear to show a racial difference in basal metabolism, pulse rate and blood pressure. Examination of medical students in China showed that they had average basal metabolic rates, pulse rates and blood pressures significantly below those of their age-mates among the medical students in New York. Some of these American students went to Pekin for their internships and residencies. After two years in the Orient it was found that these data for the white American students had fallen considerably, though they did not reach those for the native Chinese students.

It is quite possible that what we consider normal or average for these metabolic functions in this country may be dependent to a great extent on our way of life.

Speculations are often made on differences in brain size and complexity of the cortical areas. Almost fifty years ago an anatomist at Johns Hopkins measured the brains stored in the museum of the medical school. He and his students reported that the brains of the Caucasians were larger and more developed than those of the Orientals and these in turn superior to those of the Negroes. The study was repeated on the same specimens a few years later with one difference. In the second study the labels were replaced by code numbers that were not identifiable by the students making the observations. This time no significant difference was found.

One should not leave the study of blood and the circulation without exposing some of the popular fallacies concerning race and blood. We point out, of course, that heredity and the racial differences are transmitted by the genes in the gametes and not by blood.

In the study of the blood groups it is necessary to guard against a common misunderstanding. When we say that there are racial differences in the groups that is not to say that there is a racial difference in the individuals. The blood groups are determined by genes. One racial type may have more individuals with the gene for O or A or B than another. Among the Japanese the incidences are roughly 55% A, 32% B and 27% O. These ratios are also true for the Germans who are a much different race from the Japanese. The percentages for Poland are similar to those for North China. The high percentage of O among the Americans is taken as evidence of their Asiatic origin. In this topic one points out that it is harmless to receive a transfusion from a person of another race if the donor is of the same blood group but that the wrong blood from a person of the same race may be fatal.

When studying vaccines ask your class if they have ever been harmed seriously by receiving material from cows, rabbits or horses. Point out to them that rarely have people refused to accept immunization by inoculation of material made from louse intestine, macerated chick embryo, pustules from calves, suspensions of hundreds of millions of dead bacteria or extracts from the desiccated brains of rabid rabbits. Yet on the floor of Congress violent objection was made to the proposal to use the blood of a man for a transfusion into another man

simply because the proposed donor had a certain layer in his skin characterized by the presence of a larger deposit of melanin than was in the skin of the recipient. The objection on the ground that it would "mongrelize" the white race is rich material for classroom discussion of genetics, physiology and society.

In the study of the skin it should be made clear that here we find two examples of a true racial difference. These are seen in the stratum pigmentosum and in the shape of the hair follicles which give the characteristic shape to the shaft of the hair. As was said before whatever the origin of these differences they can no longer be considered as evidence of fitness of man as a biological animal.

The final suggestion is related to the history of biology, the great men whose names we mention as the heroes of science. If the nationalities of these men are mentioned when we discuss their work it will become apparent that no ethnic group has a monopoly of genius.

There are numerous topics in the course of study in biology which have implications for the understanding of the science of race. To the high school youngster it should be made clear that there are race differences which probably arose in the same way that variations of other animals came about, that these differences are not of the nature of fitnesses, that all races have great potentialities for service to mankind and that the doctrines of racism have no foundation in fact.

LETTERS

Dear Dr. Breukelman:

. . . We understand that there is also pending before the United States Interstate Commerce Commission, Washington, D. C., an application for a blanket 10% increase in *all* express charges regardless of classification. The enclosed Bulletin gives special information pertaining to the shipment of LIVE ANIMALS. I am certain that the charges now in effect and others proposed are not going to be paid willingly by school authorities.

Most school men do not know about the new and proposed rates. Once they understand, we find that they cancel orders (that must be sent by regular express) in large volume. We believe that they will be more and more concerned when the facts are known. Protests from all over the United States are in order to the United States Interstate Commerce Commission. I believe that readers of *The American Biology Teacher* would be particularly interested in knowing the facts.

Rates that discriminate prohibitively against shipments of live animals for educational and scientific use are not wise or in the public interest. . . .

We believe that a direct protest from you would carry weight with the United States Interstate Commerce Commission.

Very cordially yours,

CHARLES E. BURT, Manager
Quivira Specialties Co.,
Topeka, Kansas

A copy of our January 1950 Bulletin was sent to the President, Railway Express Agency, Inc., 230 Park Avenue, New York 17, New York. His reply is quoted as follows:

Mr. Charles E. Burt
Quivira Specialties Company
Topeka, Kansas

Dear Mr. Burt:

Your letter of January 17 gives me a lot of concern, not alone because it forecasts the loss of a substantial portion of your traffic, which we can ill afford to lose, but of equal seriousness is the apparent failure to fully evaluate the basic reasons, such as constantly mounting costs that compelled us to adjust our rates.

You realize, I am sure, that every commodity we have to buy to maintain the service has increased in price since the war and that to remain in business we must have increased revenues with which to pay our bills. In that respect our problem is identical with yours—we cannot long remain in business when expenses exceed income.

On May 6, 1949, an Emergency Fact-Finding Board appointed by the President of the United States recommended that our employes be granted an increase in wages of seven cents per hour retroactive to October 1, 1948, and a five-day 40-hour work week to become effective September 1, 1949. These recommendations, accepted by both parties in the dispute, will increase our cost of operation by not less than $14,358,084 annually. As over 80% of our cost dollar goes for wages, the necessity for increased rates can readily be seen.

In our opinion, the increased ratings on live animals, frogs, fish and snakes were fully justified because of the special handling such animals require. The correct rating and minimum charge on each is as follows:

Live Specimens	Rate	Minimum Charge
Cactus	1	$0.86
Snakes	2 ×1	1.72
Alligators	2 ×1	1.72
Turtles	1½ ×1	1.29
Fish	1½ ×1	1.29
Mammals	2 ×1	2.00
Birds	2 ×1	2.00
Frogs	1½ ×1	2.00

In the light of the foregoing explanation I trust you will have a better understanding as to the necessity of establishing minimum charges for performing a complete and specialized service in the handling of this particular traffic.

I am truly appreciative for your writing me so frankly about your situation and I want to express my personal thanks for your valued patronage in the past. We need your traffic—every pound of it—and I hope you will recognize the merits of our position and the compelling reasons for the rate changes that have been made and will find it possible to continue to use our service.

Yours very truly,

A. L. Hammell, *President*

Miss Ruth Dodge, President National Association of Biology Teachers
24 East Linden Street
Alexandria, Virginia

Dear Miss Dodge:

I noted your name and official position in the Nature magazine and thought you would be interested in what I am about to state. I am a seventy-four year old physician, still in active practice, but not so active but that I have some time for my hobbies.

For nearly fifty years, I have been a collector of insects and have an extensive collection. Although by far the greatest part of it was gathered from North Western Ohio, I also have a good many specimens obtained by exchanges and collected myself in other states and countries. Nearly twenty years ago, when I was a member of the school board, I began organizing nature study clubs of a dozen or more youngsters each summer, who would be studying biology the following year, teaching them how to make a collection as required for their biology course. I was a firm believer that biology and nature study should be given much more of a place in the high school curriculum and that the teachers should be able to take the classes out to study nature itself, which would be impossible for a coach, whose time would be taken up with the training of his teams. I observed that youngsters in my clubs were very enthusiastic and from the training they received in observation and classification, they were practically without exception the best students in their classes, not only biology but in other subjects. Too, I was rewarded with some fine friendships with them through later years.

With this rather lengthy introduction I wish to have it known by biology teachers, who might be interested, that I would be glad to be put in touch with them by mail and be of whatever assistance I could be in providing them with a representative collection of the different orders of insects.

I have devised a standard case similar to but much less expensive than the Riker mount, but which has I think these superior advantages. The transparency is of plastic

and tinted soft paper of the Kleenex type is put over the cotton which adds to the beauty of the display and to the lightness of the case. My cases are 12 by 8½ inches. Half size cases of 6 and 4½ inches could be made and would stack up perfectly with the larger cases. My plan is not to detract from the beauty of the specimens with labels, but to attach the identification history to the back. This would be a preferable plan to determine in any examinations what the pupils had learned. I was able to purchase from a firm in Troy, Ohio, steel cabinets with drawers of the right dimensions, which served admirably for the housing and preservation of my insects. One cabinet holds 100 cases with additional room for books and notes. I prepared a mimeographed pamphlet for the members of my clubs, which furnished them information on how to spread and preserve their insects and be able to display them for the interest and pleasure of others. I shall be glad to hear from you.

Sincerely yours,

Chas. J. Wehr, M.D.
Physician and Surgeon,
Bellevue, Ohio

CONSERVATION KIT

Conservation is everybody's business, a new kit of Teach-O-Filmstrips, has just been released by Popular Science Publishing Co, 353 Fourth Ave., N. Y. 10, N. Y. in answer to the call of the N.E.A. and other educational organizations for more teaching of conservation. Produced in co-operation with World Book Encyclopedia, the new series has been made with the help of educational consultants from the Soil Conservation and Forest Services of the U. S. Department of Agriculture.

Designed for Social Studies and General Science classes of seventh, eighth and ninth grades, the series consists of four filmstrips, each over 50 frames in length, and all in full, natural color. Frames appearing in the strips were culled by subject-matter and curriculum experts after six months' combing of visual conservation source materials. Many of the photographs are official U. S. Government pictures. Others are original drawings and photographs especially enacted for the series.

A broad interpretation of the subject characterizes the entire series which includes conservation of human life and health. Titles of the four strips are: *People—Our Most Valuable Resource; Saving the Soil; Using our Forests Wisely; Nothing can Live Without Water.* Each strip is a self-contained unit of instruction, with an introduction, development of basic content, summarization and suggested follow-up activities. Price is $24.75. Available at audio-visual dealers throughout the country or direct from Popular Science, Audio-Visual Division, 353 Fourth Avenue, New York 10, N. Y.

FILMS

Life of a plant, a new one-reel color film on the life cycle of a typical flowering plant, has just been released by Encyclopaedia Britannica Films.

Portraying in minutest detail a science subject which is universally studied at almost all levels of the school curriculum, the film will find a wide use in teaching, although it was designed principally for the middle grades science program.

Using the garden pea as a representative flowering plant, the film permits the viewer to watch a plant grow in a few seconds by means of time-lapse photography.

In subsequent sequences animated drawings reveal the processes going on inside the plant. Water and minerals move up from the soil through the roots and stems; carbon dioxide enters the leaves. Through a cross section view of the flower, drawings depict the female and male parts and the film describes the processes of pollination and fertilization, essentially the same for every flowering plant.

The film may be purchased from Encyclopaedia Britannica Films, Wilmette, Illinois, for $90. It may be rented from most film rental libraries or from any of EBF's six libraries in New York, Boston, Atlanta, Chicago, Dallas, or Pasadena, at $4 for one to three days' use, plus $1 for each additional day.

POPULAR SCIENCE PUBLISHING COMPANY announces release of its first science filmstrips in three years: a *Science Education Teach-o-Filmstrip Package,* consisting of three full-color series, a total of nine filmstrips, that provide complete vertical and horizontal coverage of the elementary science curriculum.

The three filmstrip series are entitled WEATHER; PLANTS AND ANIMALS; and MATTER–ENERGY. Each follows the same pattern as the others—each has three filmstrips, the first for Grades 3 and 4; the second for Grades 5 and 6; the third for Grades 7 and 8. Each series carries one science topic through all the grades in graded complexity. Thus, teachers may use one series for complete vertical penetration of one subject; or may use one strip from each series for horizontal coverage of three science subjects on the same grade level.

Each filmstrip consists of 50 full-color frames; each series of three strips has a total of 150 frames. All frames are entirely original; none are reproductions from any textbook or publication. Strips utilize a variety of visualizations, including photographs, drawings, charts, diagrams and text frames. Each series is accompanied by a free, completely-illustrated Teaching Guide. Further information about this unique new Science Filmstrip package may be obtained from Popular Science Publishing Company, Audio-Visual Division, 353 Fourth Avenue, New York 10, New York.

UNITY OF SCIENCE ESSAY CONTEST

The Institute for the Unity of Science is sponsoring an essay contest open to students of any institution of higher learning dealing with the subject, "The Divorce Between Science and Philosophy," examining its historical origins, its logical basis, and proposals for its termination. A prize of $300 will be awarded for the best essay and two additional prizes of $100 will be given for the next two best essays submitted before January 1, 1951. For complete contest rules write the Institute for the Unity of Science, American Academy of Arts and Sciences, 28 Newbury Street, Boston 16, Massachusetts.

Plant Societies of the Colorado and Mexican Plateaus*

LESLIE A. KENOYER
Western Michigan College of Education, Kalamazoo

The highlands of central Mexico are an extension of the plateau of the western United States. Similar vegetation types occur in similar edaphic and climatic situations in both areas. They also have many genera in common. The broad northern grassland area narrows toward the south and has pretty well tapered off by the time the Mexican border is reached. Chaparral or scrub forest is extensive in northern Mexico.

As is generally known, altitude has much the same influence as latitude on vegetation types. By travelling in Mexico from the tropical lowlands to the high peaks, a journey of twenty or thirty miles one would proceed through a tropical forest, a zone of semitropical vegetation including sweet gum, an oak zone, a pine zone, a fir zone, a zone of low shrubs and a zone of matted, alpine herbs. In short, the journey would be practically an epitome of the ecological zones encountered in a six thousand mile trip from the tropics to the Arctic region.

* Paper presented at the Regional meeting of the NATIONAL ASSOCIATION OF BIOLOGY TEACHERS held in Detroit, Michigan, November 19, 1949.

In the Rockies the succeeding zones are somewhat similar, the tropical being, of course, omitted.

Combined with the temperature influence is the humidity influence, in which rainfall, atmospheric moisture and water-retaining capacity of the soil must be taken into consideration. Dry areas of the Rockies are occupied by desert types, such as stonecrops, cacti and yuccas. The same groups extend into Mexico where they are often represented by larger species, such as the columnar cacti and the tree yuccas. The sagebrush of the western states is largely replaced by creosote bush and Leucophyllum in northern Mexico. Slightly higher but still relatively dry areas are occupied in both republics by characteristic juniper-nut pine formations of relatively small and sparsely distributed trees. Oaks, and at somewhat higher altitudes, pines, occupy the same temperate climate level in both countries. At higher altitudes these are replaced by firs (and in the United States, spruces), which on wind-swept slopes assume the characteristic elfin timber form. These yield to mountain meadows made up of low, matted plants and extending to the altitude at which perpetual snow draws the limit to plant associations. In the tropics of Mexico large-leaved plants and climbers prevail. Epiphytes consist mainly of bromeliads and orchids. Parasites such as dodder and mistletoe are common. These interesting groups extend upward into the realm of the oaks.

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Reviews

BOOKS

GATES, FRANK C. *Field Manual of Plant Ecology*. McGraw-Hill Book Company, New York. xv + 137 pp. illus. 1949. $3.00.

Materials presented in this book have grown out of the experiences of the author who has spent more than three decades directing students during summer sessions in their ecological explorations at the University of Michigan Biological Station, as well as during his lengthy tenure of service at the Kansas State College. The author presents the material in keeping with Agassiz's famous maxim: "Study Nature Not Books." Yet he does not ignore books inasmuch as the best references are listed for student guidance in connection with his field work. However, the primary aim is to work with plants as and where they live in their environment. A minimum amount of equipment is required. The basic concepts of ecology are presented as well as very explicit directions for the experiments given. The book may well serve in many cases as combined text and manual. Or the book is suitable to be used in connection with any standard text in plant ecology. This is where it is probably intended to find its greatest use. Various methods for making quadrats, transects, mapping and charting are given; as well as their application to different habitats. The exercises may be modified for use in any part of the country.

Not only are exercises given for field work, but a number dealing with plant anatomy and physiology are included, from which many valuable suggestions for conducting general biology and botany laboratories in both high school and college classes may be found. While the book would not probably fill the needs as a text for elementary courses in biology, it is especially recommended to those who feel the need of the know-how to conduct successful field trips—an art in which the author is indeed adept.

J. A. TRENT
Oklahoma Baptist University,
Shawnee, Oklahoma

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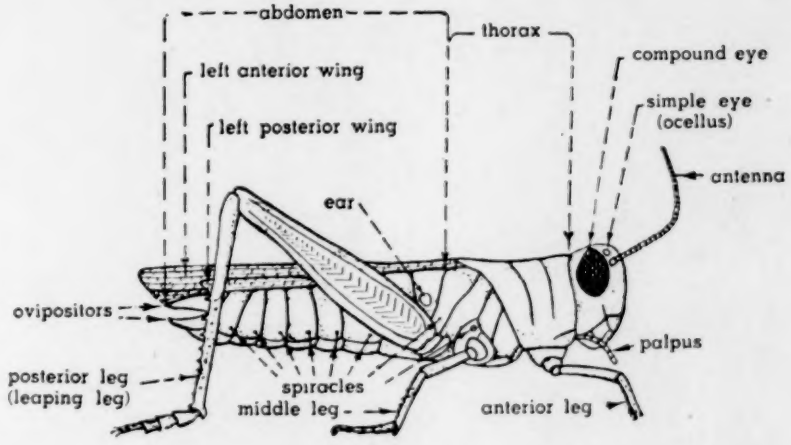

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